Swanson, L.W. (2004) Brain maps: structure of the rat brain, 3rd edition

This file has the first Nomenclature Table. In the book, the list of terms was in the left column, and footnote annotations were nearby in the righ column (instead of at the end, as here).

TABLE A. MAJOR PARTS OF THE NERVOUS SYSTEM

BASIC SUBDIVISIONS OF THE NERVOUS SYSTEM (NS) **[1]**
c. **Central Nervous System** [neuraxis, cerebrospinal axis] (CNS)
- c.g. **Central nervous system gray matter** (CNSg) **[2]**
  - c.g.1. **Cerebrum** [cerebral hemispheres, endbrain, telencephalon] (CH) **[3]**
    - c.g.1.1. **Cerebral cortex** [pallium] (CTX)
      - c.g. 1.1.1. **Cortical plate** [layers 1-6a] (CTXpl) **[4]**
        - c.g.1.1.1.1. **Sensory-motor cortex** (CTXsm)
        - c.g.1.1.1.2. **Polymodal association cortex** (CTXpm)
      - c.g. 1.1.2. **Cortical subplate** [layer 6b or 7, claustral complex] (CTXsp) **[5]**
    - c.g.1.2. **Cerebral nuclei** [corpus striatum, basal ganglia] (CNU) **[6]**
      - c.g.1.2.1. **Striatum** (STR)
      - c.g.1.2.2. **Pallidum** (PAL)
  - c.g.2. **Cerebellum** [parencephalon] (CB)
    - c.g.2.1. **Cerebellar cortex** (CBX)
    - c.g.2.2. **Cerebellar nuclei** (CBN)
  - c.g.3. **Cerebrospinal trunk** [truncus cerebrospinalis] [TK]
    - c.g.3.1. **Sensory system** (SEN)
      - c.g.3.1.1. **Thalamus** (TH)
      - c.g.3.1.2. **Visual** (SENvis)
      - c.g.3.1.3. **Somatosensory** (SENss)
      - c.g.3.1.4. **Auditory** (SENaud)
      - c.g.3.1.5. **Gustatory** (SENgu)
      - c.g.3.1.6. **Visceral** (SENvsc)
      - c.g.3.1.7. **Humerosensory** (SENhum)
    - c.g.3.2. **Behavioral state system** (STA)
    - c.g.3.3. **Motor system** (MOT)
      - c.g.3.3.1. **Behavior control column** (BCC)
      - c.g.3.3.2. **Superior colliculus, motor related** (SCm)
      - c.g.3.3.3. **Postcerebellar and precerebellar nuclei** (CBPP)
      - c.g.3.3.4. **Vestibulomotor regions** (VMO)
      - c.g.3.3.5. **Central gray** (CG)
      - c.g.3.3.6. **Hypothalamic periventricular region** (PVR)
      - c.g.3.3.7. **Reticular formation** (RET)
      - c.g.3.3.8. **Motoneuron groups** (MNG)
- c.w. **Central nervous system white matter** (cnsw)
  - c.w.1. **Cranial nerves** (crn), **spinal nerves** (spin), and **related**
  - c.w.2. **Cerebellum related fiber tracts** (cbf)
  - c.w.3. **Lateral forebrain bundle system** (lfbs)

c.w.4. **Extrapyramidal fiber systems** (eps)
c.w.5. **Medial forebrain bundle system** (mfbs)

p. **Peripheral Nervous System** (PNS) **[7]**
p.1. **Ganglia** (G)
p.1.1. **Sensory ganglia** (GSE) **[7]**
p.1.1.1. **Cranial sensory ganglia** (GCR)
p.1.1.2. **Spinal sensory ganglia** (GSP)
p.1.2. **Autonomic ganglia** (GA)
p.1.2.1. **Sympathetic ganglia** (GSY)
p.1.2.1.1. **Paravertebral sympathetic ganglia** (GPAS)
p.1.2.1.2. **Prevertebral sympathetic ganglia** (GPRS)
p.1.2.1.3. **Sympathetic plexuses** (SPX)
p.1.2.2. **Parasympathetic ganglia** (GPA)
p.1.2.2.1. **Cranial parasympathetic ganglia** (GPC)
p.1.2.2.2. **Sacral parasympathetic ganglia** (GPS)
p.1.2.2.3. **Parasympathetic plexuses** (PPX)
p.1.3. **Enteric nervous system** (ENS)
p.1.3.1. **Submucosal plexus** (sup)
p.1.3.2. **Myenteric plexus** (myp)
p.2. **Nerve fibers** (nfi)
p.2.1. **Nerves** (n)
p.2.1.1. **Cranial nerves** (cran)
p.2.1.2. **Spinal nerves** (spin)
p.2.2. **Nerve plexuses** (plx)

v. **VENTRICULAR SYSTEM** (VS)
v.1. **Lateral ventricle** (VL)
v.1.1. **rhinocele** (RC) **[8]**
v.1.2. **subependymal zone** (SEZ) **[9]**
v.1.3. **choroid plexus** (chpl)
v.1.3.1. **choroid fissure** (chfl)
v.2. **Interventricular foramen** (IVF)
v.3. **Third ventricle** (V3)
v.3.1. **hypothalamic part** (V3h)
v.3.2. **preoptic recess** (V3p)
v.3.3. **periventricular recess** (V3r) **[10]**
v.3.4. **infundibular recess** (V3ir)
v.3.5. **mammillary recess** (V3m)
v.3.6. **thalamic part** (V3t)
v.3.6.1. **choroid plexus** (chp3)
v.3.6.1.1. **choroid fissure** (chf3)
v.3.7. **pineal recess** (V3pi)
v.4. **Cerebral aqueduct, general** (AQg)
v.4.1. **cerebral aqueduct proper** (AQ)
v.4.2. **collicular recess** (AQc)
v.4.3. **subcommissural organ** (SCO) **[11]**

v.5. **Fourth ventricle, general** (V4g)
v.5.1. **fourth ventricle proper** (V4)
v.5.2. **median aperture** (MAP)
v.5.3. **lateral aperture** (LAP)
v.5.4. **lateral recess** (V4r)
v.5.5. **rostral medullary velum** (RMVE) **[12]**
v.5.6. **caudal medullary vellum** (CMVE) **[12]**
v.5.6.1. **choroid plexus** (chp4)
v.5.6.1.1. **choroid fissure** (chf4)
v.6. **Central canal, spinal cord/medulla** (C)

g. **GROOVES** (grv) (rat)
g.1. **Cerebral cortex** (grvc)
g.1.1. **endorhinal groove** (eg) **[13]**
g.1.2. **hippocampal fissure** (hf)
g.1.3. **rhinal fissure** (rf)
g.1.4. **rhinal incisure** (ri) **[13]**
g.2. **Cerebellar cortex** (grvcb) **[14]**
g.2.1. **precentral fissure** (pce)
g.2.2. **precentral fissure a** (pcea)
g.2.3. **precentral fissure b** (pceb)*
g.2.4. **intracentral fissure 2** (ice2)
g.2.5. **caudal intracentral fissure** (icec)*
g.2.6. **preculminate fissure** (pcf)
g.2.7. **intraculminate fissure 1** (icu1)
g.2.8. **posterodorsal intraculminate fissure** (icupd)*
g.2.9. **primary fissure** (pri)
g.2.10. **declival fissure 2** (def2)
g.2.11. **posterior superior fissure** (psf)
g.2.12. **prepyramidal fissure** (ppf)
g.2.13. **pyramidal fissure** (pyf)*
g.2.14. **secondary fissure** (sec)
g.2.15. **uvular fissure 1** (uf1)
g.2.16. **posterolateral fissure** (plf)
g.2.17. **nodular fissure** (nf)*
g.2.18. **simple fissure** (sif)*
g.2.19. **crus 1 fissures 1-3** (cr1f1-3)
g.2.20. **intercrural fissure** (icf)
g.2.21. **crus 2 fissure** (cr2f)*
g.2.22. **ansoparamedian fissure** (apf)
g.2.23. **intraparafloccular fissure** (ipf)
g.2.24. **paramedian sulcus** (pms)
g.2.25. **parafloccular sulcus** (pfs)
g.3. **Spinal cord (grvs)**
g.3.1. **dorsal median septum** (dms)
g.3.2. **ventral median fissure** (vmf)

m. **MENINGES** (MEN)
- m.1. **Dura** (D)
- m.2. **Arachnoid** (A)
  - m.2.1. **velum interpositum** (VIP)
- m.3. **Pia** (PI)

t. **MISCELLANEOUS TOPOGRAPHIC TERMS** (rat)
- **amygdala** (AMY) **[15]**
- **anterior lobe, cerebellum** (ALC) **[16]**
- **autonomic nervous system** (ANS)
- **brain** [encephalon] (BR) **[17]**
- **brainstem** [truncus cerebri] **[18]**
- **flocculonodular lobe, cerebellum** (FNL) **[16]**
- **forebrain** [prosencephalon] **[19]**
- **frontal pole, cerebral cortex** (FRP)
- **hindbrain** [rhombencephalon] **[20]**
- **hypothalamus [21]**
- **interbrain** [diencephalon] **[22]**
- **medulla** [myelencephalon, medulla oblongata] **[23]**
- **midbrain** [mesencephalon] **[24]**
- **occipital pole, cerebral cortex** (OCP)
- **parasympathetic system** (PSY)
- **pons** [metencephalon] **[25]**
- **posterior lobe, cerebellum** (PLC) **[16]**
- **septal region** (SEP) **[26]**
- **spinal cord** [medulla spinalis, truncus spinalis] **[27]**
  - **cervical level, segments 1-8** (SP-C1-8)
  - **thoracic level, segments 1-13** (SP-T1-13)
  - **lumbar level, segments 1-6** (SP-L1-6)
  - **sacral level, segments 1-4** (SP-S1-4)
  - **coccygeal level, segments 1-3** (SP-Co1-3)
  - **filum terminale** (ft)
- **sympathetic system** (SYM)
- **tectum [28]**
- **tegmentum [29]**
- **temporal pole, cerebral cortex** (TEP)
- **ventral thalamus [30]**

1 These two divisions (c, p) of Table A arrange systematically the various major regions of gray matter (predominantly neuronal cell bodies and neuropil) and white matter (predominantly axon bundles) in the mammalian central (c) and peripheral (p) nervous system. The arrangement scheme is designed to facilitate descriptions of nervous system circuitry or network organization. The ventricular system (v), major grooves associated with the CNS (g), coverings of the CNS (m), and various miscellaneous terms (t) are dealt with in succeeding divisions of Table A. The first systematic taxonomy like this was published by His (1895), for features of the human nervous system that are visible upon gross dissection.

2 In this scheme, the CNS has three basic divisions—cerebrum, cerebellum, and cerebrospinal trunk, with the latter parcelled into sensory, behavioral state, and motor system components. This arrangement is based on a combination of topographic, embryological, and functional systems (circuit or network) considerations (Swanson 2003a). As reviewed elsewhere (Swanson 2000b), there are many ways of grouping the 10 major CNS regions that are universally recognized in vertebrates: cerebral cortex, cerebral nuclei (basal ganglia), thalamus, hypothalamus, midbrain tectum, midbrain tegmentum, pons, cerebellum, medulla, and spinal cord (see part t of Table A). Two are shown in fig. 11 (the one adopted here and one based purely on embryological considerations). Obviously, one can be described in terms of the other. That is, the two can be indexed systematically. The brain as commonly defined today includes the cerebrum, cerebellum, and brainstem (interbrain, midbrain, pons, and medulla).

3 Definitions of the cerebrum have changed over the years (Swanson 2000b). Since Aristotle it has referred to the entire brain (that part of the CNS within the cranium), as well as to the cerebral hemispheres or endbrain—that part of the neural tube derived embryologically from lateral ventricular neuroepithelium. Based on evidence reviewed elsewhere (Alvarez-Bolado et al. 1995; Alvarez-Bolado and Swanson 1996; Swanson 2000c), the cerebrum contains two major divisions, cortex and nuclei (or basal nuclei or ganglia). Note that the terms amygdala and septal region no longer appear as major divisions of the endbrain; they are arbitrarily defined regions that contain heterogeneous nuclei and/or cortical areas.

4 For about 150 years the adult mammalian cerebral cortex has been divided into histologically distinct areas, which have been grouped in various ways by different researchers. During development the entire cortical mantle displays a cortical plate that may (isocortical) or may not (allocortical) be fitted into a basic six-layered scheme (Vogt and Vogt 1919), numbered 1-6 here. These terms are preferred to the equivalent homotypical and heterotypical of the Vogt's pupil, Brodmann (1909), and to the terms neocortical, archicortical, and paleocortical (Ariëns Kappers 1909), all of which imply unsubstantiated phylogenetic and ontogenetic attributes (see Lorente de Nó 1934; Ebbesson 1980; Swanson 2000b). The olfactory cortex (including superficial parts of the amygdala) and hippocampal formation would form the allocortex, as interpreted here. Until and if it is established how allocortical layers correspond to isocortical layers, traditional ways of naming allocortical layers will be retained here. In addition, a traditional approach to naming cortical areas, based on Brodmann's work and ultimately general for all mammals, has been adapted here. For another scheme, idiosyncratic to the rat, see Zilles and Wree (1995). Names of the 6 isocortical layers, from superficial to deep, include: 1, molecular layer; 2, superficial supragranular pyramidal layer; 3, deep supragranular pyramidal layer; 4, granular layer; 5, infragranular pyramidal layer; and 6, polymorph layer.

5 The structures listed here develop dorsal to the cerebral nuclei, and apparently deep to the cortical plate (although this remains controversial). Their projection neurons appear to use excitatory amino acids rather than GABA (which is used by most cortical nuclear projection neurons). Many suggestions in the older and more recent literature indicate that the deep amygdalar nuclei listed here are related to the claustrum, and the endopiriform nucleus was often included in the claustrum in the older literature. Fiber tracts perhaps analogous to the extreme capsule lie superficial to layer 6b (Vandevelde et al. 1996) and the endopiriform nucleus. The embryological origin of isocortical layer 6b in the rat is unclear (subplate or deep cortical plate; see next note). For convenience, traditional cortex refers to layers 1-6a, although layer 1 (which contains scattered neurons) is derived embryologically from the preplate, which is quickly divided into layer 1 and the subplate by the cortical plate (see Alvarez-Bolado and Swanson 1996).

6 In mammals, lateral and medial ventricular ridges (ganglionic eminences) develop into the classical striatum and pallidum, respectively (see Alvarez-Bolado and Swanson 1996 for review). To simplify endbrain organization, we have placed all regions that appear to develop from the ventricular ridges into either the pallidum or striatum, broadly defined. In general, cortex projects to striatum (and sometimes pallidum) via excitatory inputs, striatum projects to pallidum via inhibitory inputs, and both striatum and pallidum generate inhibitory descending projections (Swanson 2000c; 2003a).

7 Like the CNS, the PNS can be divided roughly into "gray matter" regions containing neuronal cell bodies and neuropil (ganglia), and "white matter" containing bundles of nerve fibers (nerves). For clarity, peripheral nerve fibers transmitting information toward the CNS are referred to as afferent, whereas those transmitting information away from the CNS are referred to as efferent. In the CNS, cell groups (regions) and fiber tracts transmitting information predominantly toward the cognitive system (cerebral hemisphere) rather than the motor system are referred to as sensory.

8 The obliterated olfactory extension of the lateral ventricle (Craigie 1925).

9 Privat and Leblond 1972; Bayer et al. 1991.

10 D.A. Brittain and L.W. Swanson (personal observations).

11 Wislocki and Leduc 1954.

12 Voogd 1995.

13 Craigie 1925.

14 Larsell 1952, 1970; Voogd 1995; Voogd et al. 1996. We have named several fissures, indicated by an asterisk (*), not named in the aforementioned works.

15 Swanson 1992; Swanson 2003b.

16 Larsell 1952, 1970; Voogd 1995; Voogd et al. 1996.

17 The contents of the CNS within the skull or cranium (see Swanson 2000b).

18 There have been many definitions of brainstem through history (Swanson 2000b). Here it refers to the segment of the cerebrospinal trunk within the skull or cranium (including the interbrain, midbrain, pons, and medulla).

19 The rostral segment of the brain, including the endbrain and interbrain (Swanson 2000b).

20 The caudal segment of the brain, including the pons and medulla (Swanson 2000b).

21 The ventral division of the interbrain (Rioch et al. 1940; Swanson 1987; Thompson and Swanson 2003).

22 The caudal division of the forebrain, including the thalamus and hypothalamus (Swanson 2000b).

23 The caudal division of the hindbrain (Swanson 2000b).

24 The intermediate segment of the brain (Swanson 2000b).

25 The rostral division of the hindbrain. By convention it does not include the cerebellum, which develops from the roof of the pons in the embryo (Swanson 2000b).

26 Swanson 1992; Swanson and Risold 2000.

27 Waibl 1973; Altman and Bayer 1984.

28 The roof or dorsal division of the midbrain, including the superior and inferior colliculi (Swanson 2000b).

29 The floor or ventral division of the midbrain (Swanson 2000b). Tegmentum also has a broader meaning—the floor of the brainstem as a whole. There is no consensus as to exactly what regions belong to the tegmentum in this sense. We have suggested that it roughly corresponds to the reticular core of the brainstem, including the central gray of the brain, raphé nuclei, and reticular formation (Swanson 1998-1999).

30 The ventral tier of the thalamus, including the zona incerta, reticular nucleus of the thalamus, and ventral part of the lateral geniculate complex (see note 72 in Table B).